PATENT ABSTRACTS OF JAPAN

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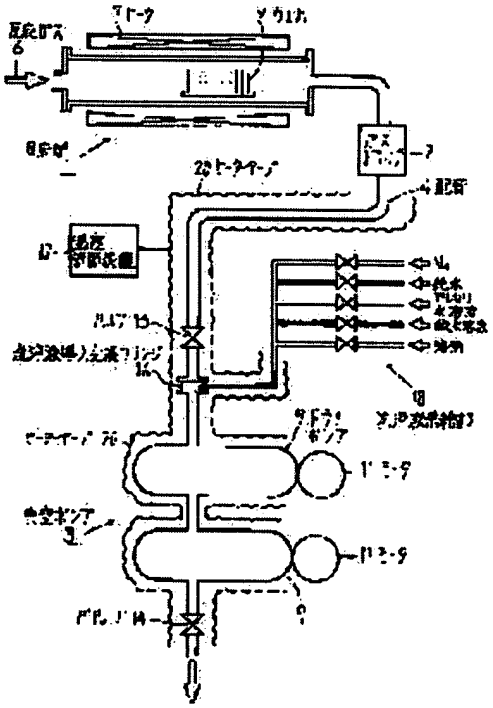
(72)Inventor : WAKABAYASHI MITSUO

(54) EXHAUSTER OF VAPOR GROWTH DEVICE AND CLEANING METHOD THEREOF

(57)Abstract:

PURPOSE: To enable the exhauster of a CVD device to be cleaned without dismounting a vacuum pump.

CONSTITUTION: The exhaust system of a CVD device is kept heated by a temperature control device 12, a cleaning solution introduction conversion flange 16 is provided to the air supply side of a vacuum pump 3, and acid water solution, alkaline water solution, pure water, organic solvent, and drying gas are successively supplied into the vacuum pump 3 through the flange 16 by switching a valve to clean, whereby deposits inside the vacuum pump 3 can be removed.



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* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] The exhauster of the vapor-growth equipment with which the exhaust-air system of vapor-growth equipment is characterized by newly coming to have the thermostat which is constituted possible [incubation] except for the motor of unreacted reactant gas, the gas trap which captures a resultant, and a vacuum pump, and performs temperature control of an exhaust-air system, the penetrant-remover installation conversion flange which supplies this penetrant remover for two or more penetrant removers to a vacuum pump with the penetrant-remover feed zone which can be supplied one by one, and two or more hot bulbs which perform a switch of piping.
[Claim 2] As an approach of washing and carrying out the reuse of the resultant which deposited in the wall of the vacuum pump which constitutes the exhaust air system of vapor growth equipment, without removing this vacuum pump from this exhaust air system the exhaust air system of this vapor growth equipment -- a thermostat -- warming, while maintaining at a condition Prepare a penetrant remover installation conversion flange in the air-supply side of this vacuum pump, and supply one by one in a vacuum pump through this flange with an acid water solution, an alkali water solution, pure water, an organic solvent, and the gas for desiccation by bulb switch, and it washes. The defecation approach of the exhauster characterized by removing the sludge in this vacuum pump.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the defecation approach of the vacuum pump which constitutes the exhaust air system of vapor growth equipment. Semiconductor devices, such as integrated circuits, such as IC and LSI, and semiconductor laser, are silicon (Si). Substrate which consists of a compound semiconductor represented with the element semiconductor represented, or a gallium and arsenic (GaAs) (wafer) It is manufactured using thin film coating technology, the photo-etching technique (photolithography), the impurity element impregnation technique, etc.
[0002] The chemical thin film forming method is mum to being suitable for formation of the very thin thin film whose physical thin film forming methods are several 10 - 1000A of numbers, although there are an approach physical as thin film coating technology and a chemical approach by ****, the former is a vacuum deposition method, a spatter, a molecular beam epitaxy (abbreviated name MBE law), etc. and the latters are vapor growth (abbreviated-name CVD method), plating, etc. It is suitable for formation of the comparatively thick thin film of order.
[0003] In addition, a CVD method performs vapor growth using a chemical reaction, supplies it on the wafer which has heated material gas with high vapor pressure with carrier gas, is made to react on a wafer, forms a thin film, and, generally is used to formation of thin films, such as the nitriding silicon (Si3N4) and diacid-ized silicon (SiO2) which are used as an insulating layer of an integrated circuit, and phosphorus silic acid glass (abbreviated name PSG).
[0004]
[Description of the Prior Art] a semiconductor integrated circuit -- silicon (Si) a semiconductor region detailed on a wafer -- making -- this field -- a conductor submicron (Sub-micron) in minimum line width, although circuit connection is made on the track and multilayer-interconnection structure is taken In this case, although the requirement of the insulating layer which constitutes a multilayer interconnection is that ****** excellent in thermal resistance and planation are excellent and CVD growth of Si3N4, SiO2, PSG, etc., etc. is performed using the CVD system from this point As this material gas, they are a mono silane (SiH4), a JI chlorination silane (SiH2Cl2), the Tori chlorination silane (SiHCl3), phosphoretted hydrogen (PH3), laughing gas (N20), ammonia (NH3), and oxygen (O2), Hydrogen (H2) etc. is used.
[0005] Drawing 3 shows the configuration of the exhaust air system which constitutes the conventional CVD system, connects a fission reactor 1, a gas trap 2, and a vacuum pump 3 by piping 4 and the bulb 5, and is constituted. Namely, although the resultant which the reactant gas 6 supplied to a fission reactor 1 by making O2, H2, etc. into carrier gas reacts on the wafer 8 currently heated at the heater 7, and is decided by the class of reactant gas grows on a wafer 8 Since a part for a heating unit is not restricted only to a wafer 8, a deposit produces it also inside the susceptor which laid the wafer 8, or a coil. Moreover, the resultant which reacted in the ambient atmosphere in a fission reactor is attracted by the vacuum pump 3, it passes along piping 4, a part deposits in the wall of piping 4 or a vacuum pump 3, and the part is discharged in atmospheric air.
[0006] Moreover, although, as for reactant gas, not all necessarily react and most part is exhausted through piping 4 by unreacted ****, since piping 4, the bulb 5, and the vacuum pump are maintained at ordinary temperature, also in this field, adhesion of a resultant and liquefaction of reactant gas have produced them. as this cure -- the former -- liquid nitrogen (N2) etc. -- while liquefying unreacted reactant gas 6 by inserting in the outlet side of a fission reactor 1 the gas trap 2 which cooled the perimeter, a resultant is made to adhere, and the measures which prevent a flow to an exhaust side are taken. however, the thing for which reactant gas and

resultants are collected only by the gas trap 2 in a CVD system -- being impossible -- a considerable amount -- the exhaust air system after a gas trap 2 -- flowing -- the -- if **** use is carried out, a vacuum pump 3 will produce failure.

[0007] That is, as a vacuum pump 3 which constitutes a CVD system, an oil is spread to hard flow and it adheres to a wafer, and neither an oil diffusion pump nor an oil sealed rotary pump is used from the standpoint which prevents spoiling quality, but a turbine pump, a mechanical booster pump, a dry pump, etc. are instead used, and serial operation of a turbine pump and a dry pump, serial operation of a mechanical booster pump and a dry pump, serial operation of dry pumps, etc. are performed.

[0008] Drawing shows the condition of carrying out serial operation of the two dry pumps 9. however -- as the result to which a resultant and the oxide of reactant gas deposit in the bucket section of a pump, the body wall section, the rotor section, etc. -- the -- if **** use is carried out, rotation will stop. Then, exchanging and overflowing a vacuum pump periodically is performed.

[0009]

[Problem(s) to be Solved by the Invention] Although unreacted reactant gas and an unreacted resultant are flowing [from using a chemical with vapor pressure high as reactant gas of a CVD system, making it react on a wafer, and depositing the resultant] in the exhaust air system through piping from the fission reactor inevitably It is difficult to capture all by the gas trap, and since it is drawn in by the vacuum pump and deposits in the bucket section of a pump, the body wall section, the rotor section, etc., it needed to remove from the exhaust air system periodically, and needed to exchange for the new article, and working capacity has been spoiled. Then, it is a technical problem to enable it to overflow, without removing from an exhaust air system.

[0010]

[Means for Solving the Problem] The above-mentioned technical problem as an approach of washing and carrying out the reuse of the resultant which deposited in the wall of the vacuum pump which constitutes the exhaust air system of a CVD system, without removing a vacuum pump from an exhaust air system A penetrant remover installation conversion flange is prepared in the air-supply side of a vacuum pump. the exhaust air system of a CVD system -- a thermostat -- warming, while maintaining at a condition It can supply one by one in a vacuum pump through a flange with an acid water solution, an alkali water solution, pure water, an organic solvent, and the gas for desiccation by bulb switch, can wash, and can solve by using the defecation approach of an exhauster of removing the sludge in a vacuum pump.

[0011]

[Function] Since vacuum pumps, such as a turbine pump with which the artificer is used for the CVD system, a mechanical booster pump, and a dry pump, did not need an internal lubricating oil but it consisted of the things which can carry out **** washing, such as the rotor section and the bucket section, it considered performing the **** acid cleaning through piping, and carrying out dissolution removal of the sludge. in addition, the product which deposits inside piping or a vacuum pump in the process which manufactures a semiconductor integrated circuit using a CVD system -- SiO2 and Si3N4 etc. -- there is much solid solution of silicon compounds, such as a silicon compound and PSG.

[0012] Next, since piping and a vacuum pump were reasons also with bigger it being also low temperature than reactant gas, adhesion of these resultants was carried out to using an exhaust air system in the state of heating as much as possible. That is, it was made to make the reactant gas containing the particle of a resultant discharge out of equipment as straight as possible by newly forming a temperature controller and if possible maintaining at an elevated temperature except for parts which must not be warmed, such as a motor which operates a gas trap and a dry pump.

[0013] Moreover, the description of this invention is having been made to wash efficiently by equipping a conversion flange with shower tubing and sprinkling a drug solution to sprinkler-like by performing supply of a drug solution using a penetrant remover installation conversion flange.

[0014] Drawing 1 is the block diagram of the exhaust air system which carried out this invention, and the configuration to a fission reactor 1 and a gas trap 2 is not different from the former. That is, although most is captured when the resultant of the letter of spraying produced with unreacted reactant gas 6 and an unreacted fission reactor 1 passes along the gas trap 2 cooled with the liquid N2, remarkable gas is attracted by the vacuum pump 3 through piping 4. They are the bulbs 13 and 14 which incubation structure is taken except for the motor 11 of a vacuum pump 3 (it is the dry pump 9 in the case of this example), and the exhaust air system is prepared possible [heating] by the thermostat 12 by ****, and are used for piping 4. The hot bulb in which

temperature control is possible is used.
[0015] Next, the penetrant remover installation conversion flange 16 used for installing between a bulb 13 and a vacuum pump 3, and supplying a penetrant remover also takes incubation structure, and constitutes it possible [heating] with a thermostat 12. While discharging the reactant gas and the resultant of a CVD system which escaped capture by the gas trap 2 working in atmospheric air by taking such structure, without if possible adhering to piping 4 and a vacuum pump 3, the resultant adhering to a vacuum pump 3 can fasten a bulb 13, and can wash a vacuum pump 3 by supplying a penetrant remover from the penetrant remover feed zone 18 through the penetrant remover installation conversion flange 16.
[0016]
[Example] the exhaust air system which takes the configuration shown in drawing 1 -- setting -- as a gas trap 2 -- a liquid N2 -- a refrigerant -- ** -- the temperature of ****** was maintained at using it by carrying out, connecting to a thermostat 12 the thermocouple which has inserted the outside of piping 4, the penetrant remover installation conversion flange 16, and the dry pump 9 in winding and during this period on the heater tape 20, and performing current accommodation at 80 degrees C. In addition, water cooling of the motor 11 has been carried out.
[0017] Next, a penetrant remover feed zone is N2 feed zone, as shown in this drawing, Pure-water feed zone, Alkali water-solution feed zone, It consists of an acid water-solution feed zone and a solvent feed zone, the penetrant remover installation conversion flange 16 is led, and it is an acid in a vacuum pump, Pure water, Alkali, Pure water, It supplies in order of a solvent and was made to dry by N2 finally.
[0018] Moreover, three kinds of things shown by (A) of drawing 2 , (B), and (C) as a penetrant remover installation conversion flange 16 were used. That is, while equipping the outside of each conversion flange with the heater tape 21 and the heat insulator 22 and heating piping 23 at the heater 24, the point was equipped with the shower tubing 25, and it constituted so that a penetrant remover might be sprinkled to sprinkler-like. By ****, the arrow head from the shower tubing 25 shows the spraying direction, and (A) and (B) differ from (C) ******** sewage sprinkling.
[0019] Next, the 3 component gas of SiHCl3, NH3, and N2 was used as reactant gas, and the dry pump 11 of 2 reams was used as a vacuum pump 3. now, Si wafer top -- Si3N4 from, if the washing approach of an exhaust air system is explained about the process which forms the becoming insulating layer Bulbs 13 and 14 are closed in the condition of having heated the exhaust air system at 80 degrees C after termination of a CVD reaction in drawing 1 . From the penetrant remover installation conversion flange 16, supply a fluoric acid (HF) water solution and two dry pumps 9 are filled. It is left for 10 minutes and is Si3N4. After dissolving, open a bulb 14 and HF water solution is removed. Next, wash pure water for 1 minute by 3l. the flow rate for /, then, wash an aqueous ammonia solution (NH4OH) for 1 minute by 3l. the flow rate for /, and it neutralizes. Next, after having washed pure water for 1 minute by the 3l. flow rate for /, and ethyl alcohol's having washed the back and permuting water, washing finished by supplying N2 for 20 minutes by 10l. the flow rate for /, and drying. In addition, the significant difference was not accepted about three kinds of penetrant remover installation conversion flanges 16.
[0020]
[Effect of the Invention] Since it can wash without being able to decrease the count of washing of the exhaust air system of a CVD system by operation of this invention, and removing a vacuum pump from an exhaust air system, it can contribute to the manufacture cost reduction of a semiconductor integrated circuit.

[Translation done.]

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TECHNICAL FIELD

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[0002] The chemical thin film forming method is mum to being suitable for formation of the very thin thin film whose physical thin film forming methods are several 10 - 1000A of numbers, although there are an approach physical as thin film coating technology and a chemical approach by ****, the former is a vacuum deposition method, a spatter, a molecular beam epitaxy (abbreviated name MBE law), etc. and the latters are vapor growth (abbreviated-name CVD method), plating, etc. It is suitable for formation of the comparatively thick thin film of order.

[0003] In addition, a CVD method performs vapor growth using a chemical reaction, supplies it on the wafer which has heated material gas with high vapor pressure with carrier gas, is made to react on a wafer, forms a thin film, and, generally is used to formation of thin films, such as the nitriding silicon (Si3N4) and diacid-ized silicon (SiO2) which are used as an insulating layer of an integrated circuit, and phosphorus silic acid glass (abbreviated name PSG).

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PRIOR ART

[Description of the Prior Art] a semiconductor integrated circuit -- silicon (Si) a semiconductor region detailed on a wafer -- making -- this field -- a conductor submicron (Sub-micron) in minimum line width, although circuit connection is made on the track and multilayer-interconnection structure is taken In this case, although the requirement of the insulating layer which constitutes a multilayer interconnection is that ****** excellent in thermal resistance and planation are excellent and CVD growth of Si3N4, SiO2, PSG, etc., etc. is performed using the CVD system from this point As this material gas, they are a mono silane (SiH4), a JI chlorination silane (SiH2Cl2), the Tori chlorination silane (SiHCl3), phosphoretted hydrogen (PH3), laughing gas (N20), ammonia (NH3), and oxygen (O2), Hydrogen (H2) etc. is used.

[0005] Drawing 3 shows the configuration of the exhaust air system which constitutes the conventional CVD system, connects a fission reactor 1, a gas trap 2, and a vacuum pump 3 by piping 4 and the bulb 5, and is constituted. Namely, although the resultant which the reactant gas 6 supplied to a fission reactor 1 by making O2, H2, etc. into carrier gas reacts on the wafer 8 currently heated at the heater 7, and is decided by the class of reactant gas grows on a wafer 8 Since a part for a heating unit is not restricted only to a wafer 8, a deposit produces it also inside the susceptor which laid the wafer 8, or a coil. Moreover, the resultant which reacted in the ambient atmosphere in a fission reactor is attracted by the vacuum pump 3, it passes along piping 4, a part deposits in the wall of piping 4 or a vacuum pump 3, and the part is discharged in atmospheric air.

[0006] Moreover, although, as for reactant gas, not all necessarily react and most part is exhausted through piping 4 by unreacted ****, since piping 4, the bulb 5, and the vacuum pump are maintained at ordinary temperature, also in this field, adhesion of a resultant and liquefaction of reactant gas have produced them. as this cure -- the former -- liquid nitrogen (N2) etc. -- while liquefying unreacted reactant gas 6 by inserting in the outlet side of a fission reactor 1 the gas trap 2 which cooled the perimeter, a resultant is made to adhere, and the measures which prevent a flow to an exhaust side are taken. however, the thing for which reactant gas and resultants are collected only by the gas trap 2 in a CVD system -- being impossible -- a considerable amount -- the exhaust air system after a gas trap 2 -- flowing -- the -- if **** use is carried out, a vacuum pump 3 will produce failure.

[0007] That is, as a vacuum pump 3 which constitutes a CVD system, an oil is spread to hard flow and it adheres to a wafer, and neither an oil diffusion pump nor an oil sealed rotary pump is used from the standpoint which prevents spoiling quality, but a turbine pump, a mechanical booster pump, a dry pump, etc. are instead used, and serial operation of a turbine pump and a dry pump, serial operation of a mechanical booster pump and a dry pump, serial operation of dry pumps, etc. are performed.

[0008] Drawing shows the condition of carrying out serial operation of the two dry pumps 9. however -- as the result to which a resultant and the oxide of reactant gas deposit in the bucket section of a pump, the body wall section, the rotor section, etc. -- the -- if **** use is carried out, rotation will stop. Then, exchanging and overflowing a vacuum pump periodically is performed.

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EFFECT OF THE INVENTION

[Effect of the Invention] Since it can wash without being able to decrease the count of washing of the exhaust air system of a CVD system by operation of this invention, and removing a vacuum pump from an exhaust air system, it can contribute to the manufacture cost reduction of a semiconductor integrated circuit.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] Although unreacted reactant gas and an unreacted resultant are flowing [from using a chemical with vapor pressure high as reactant gas of a CVD system, making it react on a wafer, and depositing the resultant] in the exhaust air system through piping from the fission reactor inevitably It is difficult to capture all by the gas trap, and since it is drawn in by the vacuum pump and deposits in the bucket section of a pump, the body wall section, the rotor section, etc., it needed to remove from the exhaust air system periodically, and needed to exchange for the new article, and working capacity has been spoiled. Then, it is a technical problem to enable it to overflow, without removing from an exhaust air system.

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MEANS

[Means for Solving the Problem] The above-mentioned technical problem as an approach of washing and carrying out the reuse of the resultant which deposited in the wall of the vacuum pump which constitutes the exhaust air system of a CVD system, without removing a vacuum pump from an exhaust air system A penetrant remover installation conversion flange is prepared in the air-supply side of a vacuum pump. the exhaust air system of a CVD system -- a thermostat -- warming, while maintaining at a condition It can supply one by one in a vacuum pump through a flange with an acid water solution, an alkali water solution, pure water, an organic solvent, and the gas for desiccation by bulb switch, can wash, and can solve by using the defecation approach of an exhauster of removing the sludge in a vacuum pump.

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OPERATION

[Function] Since vacuum pumps, such as a turbine pump with which the artificer is used for the CVD system, a mechanical booster pump, and a dry pump, did not need an internal lubricating oil but it consisted of the things which can carry out **** washing, such as the rotor section and the bucket section, it considered performing the **** acid cleaning through piping, and carrying out dissolution removal of the sludge. in addition, the product which deposits inside piping or a vacuum pump in the process which manufactures a semiconductor integrated circuit using a CVD system -- SiO2 and Si3N4 etc. -- there is much solid solution of silicon compounds, such as a silicon compound and PSG.

[0012] Next, since piping and a vacuum pump were reasons also with bigger it being also low temperature than reactant gas, adhesion of these resultants was carried out to using an exhaust air system in the state of heating as much as possible. That is, it was made to make the reactant gas containing the particle of a resultant discharge out of equipment as straight as possible by newly forming a temperature controller and if possible maintaining at an elevated temperature except for parts which must not be warmed, such as a motor which operates a gas trap and a dry pump.

[0013] Moreover, the description of this invention is having been made to wash efficiently by equipping a conversion flange with shower tubing and sprinkling a drug solution to sprinkler-like by performing supply of a drug solution using a penetrant remover installation conversion flange.

[0014] Drawing 1 is the block diagram of the exhaust air system which carried out this invention, and the configuration to a fission reactor 1 and a gas trap 2 is not different from the former. That is, although most is captured when the resultant of the letter of spraying produced with unreacted reactant gas 6 and an unreacted fission reactor 1 passes along the gas trap 2 cooled with the liquid N2, remarkable gas is attracted by the vacuum pump 3 through piping 4. They are the bulbs 13 and 14 which incubation structure is taken except for the motor 11 of a vacuum pump 3 (it is the dry pump 9 in the case of this example), and the exhaust air system is prepared possible [heating] by the thermostat 12 by ****, and are used for piping 4. The hot bulb in which temperature control is possible is used.

[0015] Next, the penetrant remover installation conversion flange 16 used for installing between a bulb 13 and a vacuum pump 3, and supplying a penetrant remover also takes incubation structure, and constitutes it possible [heating] with a thermostat 12. While discharging the reactant gas and the resultant of a CVD system which escaped capture by the gas trap 2 working in atmospheric air by taking such structure, without if possible adhering to piping 4 and a vacuum pump 3, the resultant adhering to a vacuum pump 3 can fasten a bulb 13, and can wash a vacuum pump 3 by supplying a penetrant remover from the penetrant remover feed zone 18 through the penetrant remover installation conversion flange 16.

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EXAMPLE

[Example] the exhaust air system which takes the configuration shown in drawing 1 -- setting -- as a gas trap 2 -- a liquid N2 -- a refrigerant -- ** -- the temperature of ****** was maintained at using it by carrying out, connecting to a thermostat 12 the thermocouple which has inserted the outside of piping 4, the penetrant remover installation conversion flange 16, and the dry pump 9 in winding and during this period on the heater tape 20, and performing current accommodation at 80 degrees C. In addition, water cooling of the motor 11 has been carried out.
[0017] Next, a penetrant remover feed zone is N2 feed zone, as shown in this drawing, Pure-water feed zone, Alkali water-solution feed zone, It consists of an acid water-solution feed zone and a solvent feed zone, the penetrant remover installation conversion flange 16 is led, and it is an acid in a vacuum pump, Pure water, Alkali, Pure water, It supplies in order of a solvent and was made to dry by N2 finally.
[0018] Moreover, three kinds of things shown by (A) of drawing 2 , (B), and (C) as a penetrant remover installation conversion flange 16 were used. That is, while equipping the outside of each conversion flange with the heater tape 21 and the heat insulator 22 and heating piping 23 at the heater 24, the point was equipped with the shower tubing 25, and it constituted so that a penetrant remover might be sprinkled to sprinkler-like. By ****, the arrow head from the shower tubing 25 shows the spraying direction, and (A) and (B) differ from (C) ******** sewage sprinkling.
[0019] Next, the 3 component gas of SiHCl3, NH3, and N2 was used as reactant gas, and the dry pump 11 of 2 reams was used as a vacuum pump 3. now, Si wafer top -- Si3N4 from, if the washing approach of an exhaust air system is explained about the process which forms the becoming insulating layer Bulbs 13 and 14 are closed in the condition of having heated the exhaust air system at 80 degrees C after termination of a CVD reaction in drawing 1 . From the penetrant remover installation conversion flange 16, supply a fluoric acid (HF) water solution and two dry pumps 9 are filled. It is left for 10 minutes and is Si3N4. After dissolving, open a bulb 14 and HF water solution is removed. Next, wash pure water for 1 minute by 3l. the flow rate for /, then, wash an aqueous ammonia solution (NH4OH) for 1 minute by 3l. the flow rate for /, and it neutralizes. Next, after having washed pure water for 1 minute by the 3l. flow rate for /, and ethyl alcohol's having washed the back and permuting water, washing finished by supplying N2 for 20 minutes by 10l. the flow rate for /, and drying. In addition, the significant difference was not accepted about three kinds of penetrant remover installation conversion flanges 16.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the block diagram of the exhauster of the CVD system concerning this invention.
[Drawing 2] It is the sectional view showing the configuration of a penetrant remover installation conversion flange.
[Drawing 3] It is the block diagram of the exhauster which constitutes the conventional CVD system.
[Description of Notations]
1 Fission Reactor
2 Gas Trap
3 Vacuum Pump
4 Piping
5, 13, 14 Bulb
6 Reactant Gas
9 Dry Pump
11 Motor
12 Thermostat
16 Penetrant Remover Installation Conversion Flange
18 Penetrant Remover Feed Zone
20 21 Heater tape
25 Shower Tubing

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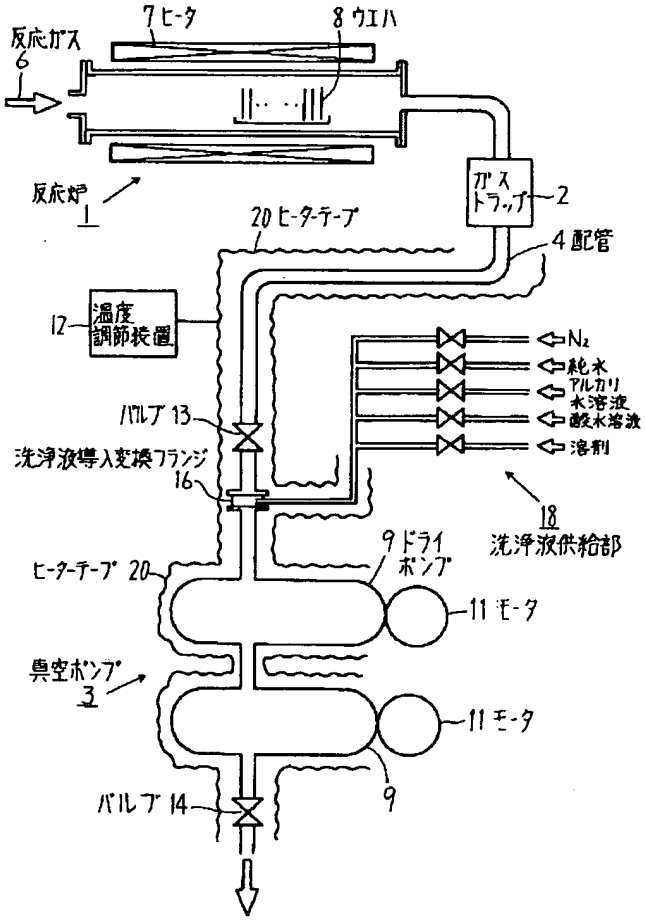
DRAWINGS

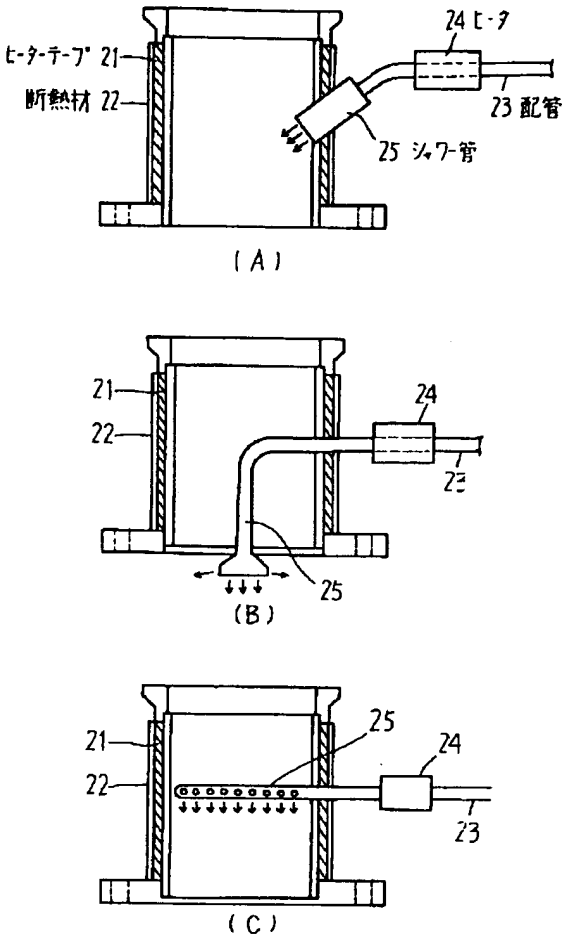
[Drawing 1]

本発明に係るCVD装置の排気系の構成図



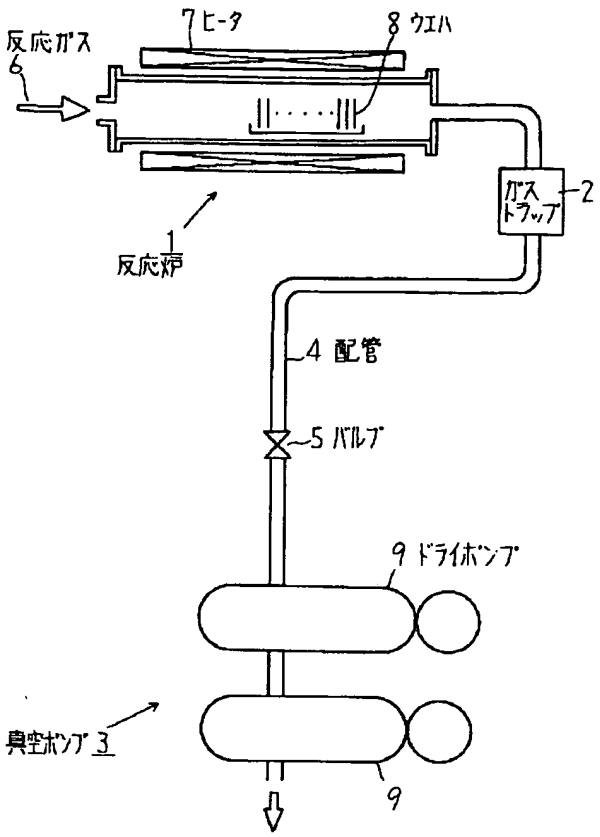
[Drawing 2]

洗浄液導入変換フランジの構造を示す断面図



[Drawing 3]

従来のＣＶＤ装置を構成している排気系の構成図



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* NOTICES *

CORRECTION OR AMENDMENT

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[Section partition] The 2nd partition of the 7th section
[Publication date] September 25, Heisei 10 (1998)

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[Date of Publication] December 13, Heisei 6 (1994)
[Annual volume number] Open patent official report 6-3428
[Application number] Japanese Patent Application No. 5-129852
[International Patent Classification (6th Edition)]

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C23C 16/44
C30B 25/14
H01L 21/205

[FI]

H01L 21/31 B
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[Procedure amendment 1]
[Document to be Amended] Specification
[Item(s) to be Amended] The name of invention
[Method of Amendment] Modification
[Proposed Amendment]
[Title of the Invention] A vacuum pump and its defecation approach
[Procedure amendment 2]
[Document to be Amended] Specification
[Item(s) to be Amended] Claim
[Method of Amendment] Modification
[Proposed Amendment]
[Claim(s)]
[Claim 1] In a vacuum pump equipped with the inlet pipe connected to the exhaust air system of vapor growth equipment, and the exhaust pipe which discharges the gas introduced from this inlet pipe,
The vacuum pump characterized by having the penetrant remover induction (16) for supplying a penetrant remover in this pump.
[Claim 2] The vacuum pump according to claim 1 characterized by having a thermostat (12) for adjusting the temperature of said pump.
[Claim 3] It is the defecation approach of the vacuum pump connected to the exhaust air system of vapor

growth equipment,
The defecation approach of the vacuum pump characterized by for a switch of a bulb supplying and washing a penetrant remover in this pump, and removing the sludge in this pump.
[Procedure amendment 3]
[Document to be Amended] Specification
[Item(s) to be Amended] 0010
[Method of Amendment] Modification
[Proposed Amendment]
[0010]
[Means for Solving the Problem] The above-mentioned technical problem can supply and wash a penetrant remover in a vacuum pump by switch of a bulb as an approach of washing and carrying out the reuse of the resultant which deposited in the wall of the vacuum pump which constitutes the exhaust air system of a CVD system, without removing a vacuum pump from an exhaust air system, and can solve it by using the defecation approach of a vacuum pump of removing the sludge in a vacuum pump.

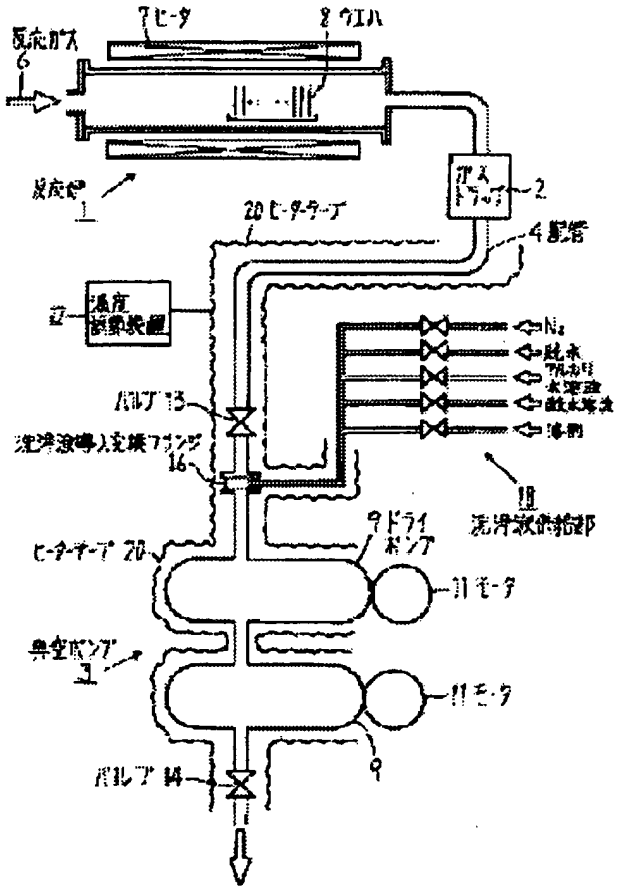
[Translation done.]

EXHAUSTER OF VAPOR GROWTH DEVICE AND CLEANING METHOD THEREOF

Patent number: JP6342785
Publication date: 1994-12-13
Inventor: WAKABAYASHI MITSUO
Applicant: FUJITSU LTD
Classification:
- international: H01L21/31; C23C16/44; C30B25/14; H01L21/205
- european:
Application number: JP19930129852 19930601
Priority number(s):

Abstract of **JP6342785**

PURPOSE:To enable the exhauster of a CVD device to be cleaned without dismounting a vacuum pump.
CONSTITUTION:The exhaust system of a CVD device is kept heated by a temperature control device 12, a cleaning solution introduction conversion flange 16 is provided to the air supply side of a vacuum pump 3, and acid water solution, alkaline water solution, pure water, organic solvent, and drying gas are successively supplied into the vacuum pump 3 through the flange 16 by switching a valve to clean, whereby deposits inside the vacuum pump 3 can be removed.



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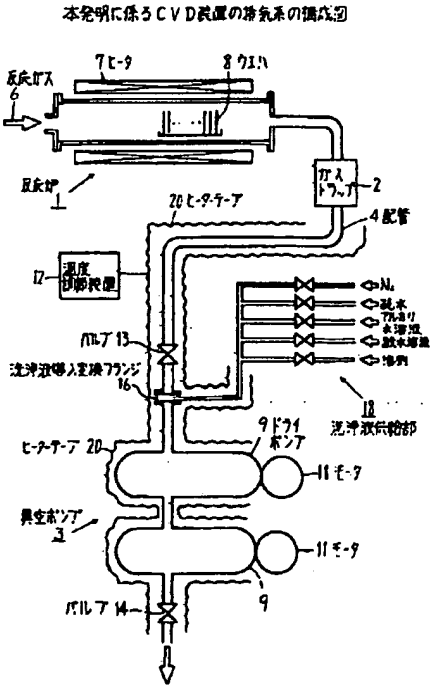
(54)【発明の名称】　気相成長装置の排気装置とその清浄化方法

(57)【要約】

【目的】　ＣＶＤ装置の排気装置に関し、真空ポンプを取り外すことなく清浄化することを目的とする。

【構成】　ＣＶＤ装置の排気系を温度調節装置により加温状態に保つと共に、真空ポンプの給気側に洗浄液導入変換フランジを設け、バルブ切り換えによりフランジを通じて真空ポンプ内に酸水溶液，アルカリ水溶液，純水，有機溶剤，乾燥用ガスと順次に供給して洗浄し、真空ポンプ内の析出物を除去することを特徴として排気装置の清浄化方法を構成する。



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【特許請求の範囲】

【請求項1】　気相成長装置の排気系が、未反応の反応ガスと反応生成物を捕獲するガストラップと真空ポンプのモータを除き保温可能に構成されており、排気系の温度調節を行なう温度調節装置と、複数の洗浄液を順次に供給可能な洗浄液供給部と、該洗浄液を真空ポンプに供給する洗浄液導入変換フランジと、配管の切り換えを行なう複数のホットバルブとを新たに備えてなることを特徴とする気相成長装置の排気装置。

【請求項2】　気相成長装置の排気系を構成する真空ポンプの内壁に析出した反応生成物を該排気系から該真空ポンプを取り外すことなく洗浄し、再使用する方法として、該気相成長装置の排気系を温度調節装置により加温状態に保つと共に、該真空ポンプの給気側に洗浄液導入変換フランジを設け、バルブ切り換えにより該フランジを通じて真空ポンプ内に酸水溶液，アルカリ水溶液，純水，有機溶剤，乾燥用ガスと順次に供給して洗浄し、該真空ポンプ内の析出物を除去することを特徴とする排気装置の清浄化方法。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は気相成長装置の排気系を構成する真空ポンプの清浄化方法に関する。ＩＣやＬＳＩなどの集積回路や半導体レーザなどの半導体デバイスはシリコン（Si）で代表される単体半導体やガリウム・砒素(GaAs)で代表される化合物半導体からなる基板（ウエハ）に薄膜形成技術，写真蝕刻技術（フォトリソグラフィ），不純物元素注入技術などを用いて製造されている。

【0002】こゝで、薄膜形成技術として物理的な方法と化学的な方法とがあり、前者は真空蒸着法，スパッタ法，分子線エピタキシャル法（略称ＭＢＥ法）などであり、後者は気相成長法（略称ＣＶＤ法）やメッキ法などであるが、物理的な薄膜形成法が数10～数1000Åの極めて薄い薄膜の形成に適しているのに対し、化学的な薄膜形成法はμm オーダーの比較的厚い薄膜の形成に適している。

【0003】なお、ＣＶＤ法は化学反応を用いて気相成長を行なうもので、蒸気圧の高い原料ガスをキャリアガスと共に加熱してあるウエハ上に供給し、ウエハ上で反応させて薄膜を形成するものであり、集積回路の絶縁層として使用される窒化硅素（Si_3N_4），二酸化硅素（SiO_2），燐硅酸ガラス（略称ＰＳＧ）などの薄膜の形成に一般的に使用されている。

【0004】

【従来の技術】半導体集積回路はシリコン（Si）ウエハ上に微細な半導体領域を作り、この領域を最小線幅がサブミクロン(Sub-micron)の導体線路で回路接続しており、多層配線構造が採られているが、この場合に多層配線を構成する絶縁層の必要条件は耐熱性に優れていることゝ、平坦化作用が優れていることであり、この点からＣＶＤ装置を用いてSi_3N_4，SiO_2，ＰＳＧなどのＣＶＤ成長が行なわれているが、この原料ガスとして、モノシラン（SiH_4），ジ塩化シラン(SiH_2Cl_2)，トリ塩化シラン（$SiHCl_3$)，フォスフィン(PH_3)，笑気(N_2O)，アンモニア(NH_3)，酸素(O_2)，水素(H_2)などが使用されている。

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【0005】図3は従来のＣＶＤ装置を構成している排気系の構成を示すもので、反応炉1とガストラップ2と真空ポンプ3を配管4とバルブ5で繋いで構成されている。すなわち、O_2やH_2などをキャリアガスとして反応炉1に供給される反応ガス6はヒータ7により加熱されているウエハ8の上で反応し、反応ガスの種類により決まる反応生成物がウエハ8の上に成長するが、加熱部分はウエハ8のみに限らぬことから、ウエハ8を載置したサセプタや反応管の内部にも析出が生じ、また反応炉内の雰囲気中で反応した反応生成物は真空ポンプ3に吸引されて配管4を通り、一部は配管4や真空ポンプ3の内壁に析出し、一部は大気中に排出されている。

【0006】また、反応ガスは必ずしも全部が反応する訳ではなく、かなりの部分は未反応のまゝで配管4を通って排気されるが、配管4，バルブ5，真空ポンプは常温に保たれているために、この領域においても反応生成物の付着と反応ガスの液化が生じている。この対策として従来は液体窒素（N_2）などにより周囲を冷却したガストラップ2を反応炉1の出口側に挿入することにより未反応の反応ガス6を液化すると共に反応生成物を付着させ、排気側への流動を防ぐ処置が施されている。然し、ＣＶＤ装置において、ガストラップ2だけで反応ガスと反応生成物を回収することは不可能であって、相当量がガストラップ2以降の排気系に流れ、そのまゝ使用すると真空ポンプ3が故障を生じる。

【0007】すなわち、ＣＶＤ装置を構成する真空ポンプ3としては油が逆方向に拡散してウエハに付着し、品質を損なうのを防ぐ見地から油拡散ポンプや油回転ポンプは使用されておらず、この代わりにターボポンプ，メカニカルブースターポンプ，ドライポンプなどを使用し、ターボポンプとドライポンプの直列運転，メカニカルブースターポンプとドライポンプとの直列運転，ドライポンプ同士の直列運転などが行なわれている。

【0008】図は二個のドライポンプ9を直列運転している状態を示している。然し、反応生成物や反応ガスの酸化物がポンプの動翼部，ボデイ内壁部，ローター部などに析出する結果として、そのまゝ使用していると回転が停止してしまう。そこで、定期的に真空ポンプを交換してオーバーフローすることが行なわれている。

【0009】

【発明が解決しようとする課題】ＣＶＤ装置の反応ガスとして蒸気圧の高い薬品を使用し、ウエハ上で反応させ反応生成物を析出させていることから、必然的に未反応の反応ガスと反応生成物は反応炉より配管を通って排気

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系に流れているが、ガストラップで全部を捕獲するのは困難であり、真空ポンプに吸引されてポンプの動翼部，ボデイ内壁部，ローター部などに析出するために、定期的に排気系より外して新品と交換する必要があり、作業能率を損ねている。そこで、排気系より外すことなくオーバーフローできるようにすることが課題である。

【0010】

【課題を解決するための手段】上記の課題はCVD装置の排気系を構成する真空ポンプの内壁に析出した反応生成物を排気系から真空ポンプを取り外すことなく洗浄し、再使用する方法として、CVD装置の排気系を温度調節装置により加温状態に保つと共に、真空ポンプの給気側に洗浄液導入変換フランジを設け、バルブ切り換えによりフランジを通じて真空ポンプ内に酸水溶液，アルカリ水溶液，純水，有機溶剤，乾燥用ガスと順次に供給して洗浄し、真空ポンプ内の析出物を除去する排気装置の清浄化方法を用いることにより解決することができる。

【0011】

【作用】発明者はCVD装置に使用されているターボポンプ，メカニカルブースターポンプ，ドライポンプなどの真空ポンプは内部潤滑油を必要とせず、ローター部や動翼部などそのまゝ洗浄できるものから構成されていることから、配管を通じてそのまゝ酸洗浄を行なって析出物を溶解除去することを考えた。なお、CVD装置を用い半導体集積回路の製造を行なう工程において配管や真空ポンプの内部に析出する生成物はSiO_2，Si_3N_4 などの硅素化合物やPSGなどの硅素化合物の固溶体が多い。

【0012】次に、これらの反応生成物の付着は配管や真空ポンプが反応ガスよりも低温であることも大きな理由であることから、排気系を可能な限り加熱状態で使用することにした。すなわち、温度制御装置を新たに設け、ガストラップやドライポンプを動作させるモータなど、加温してはいけない部分を除き、なるべく高温に保つことにより、反応生成物の微粒子を含む反応ガスをなるべくストレートに装置外に排出させるようにした。

【0013】また、本発明の特徴は薬液の供給を洗浄液導入変換フランジを用いて行なうことで、変換フランジにシャワー管を備え、薬液を如雨露状に散布することにより効率よく洗浄を行なうようにしたことである。

【0014】図1は本発明を実施した排気系の構成図であって、反応炉1とガストラップ2までの構成は従来と変わらない。すなわち、未反応の反応ガス6と反応炉1で生じた噴霧状の反応生成物は液体N_2で冷却されているガストラップ2を通ることにより大部分が捕獲されるが、かなりのガスが配管4を通って真空ポンプ3に吸引される。こゝで排気系は真空ポンプ3（この例の場合はドライポンプ9）のモータ11を除いて保温構造が採られており、温度調節装置12により加熱可能に設けられており、配管4に使用されているバルブ13,14 も温度制御が

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可能なホットバルブを使用する。

【0015】次に、バルブ13と真空ポンプ3との間に設置し洗浄液を供給するのに使用する洗浄液導入変換フランジ16も保温構造をとり温度調節装置12により加熱可能に構成する。このような構造をとることにより、CVD装置の動作中にガストラップ2での捕獲を免れた反応ガスと反応生成物はなるべく配管4と真空ポンプ3に付着することなく大気中に排出すると共に、真空ポンプ3に付着した反応生成物はバルブ13を締め、洗浄液導入変換フランジ16を通じて洗浄液供給部18より洗浄液を供給することにより真空ポンプ3の洗浄を行なうことができる。

【0016】

【実施例】図1に示す構成をとる排気系においてガストラップ2としては液体N_2を冷媒として使用し、配管4と洗浄液導入変換フランジ16およびドライポンプ9の外側をヒータテープ20で巻回し、この間に挿入してある熱電対を温度調節装置12に接続して電流調節を行なうことによ各部の温度を80℃に保った。なお、モータ11は水冷してある。

【0017】次に、洗浄液供給部は同図に示すようにN_2供給部，純水供給部，アルカリ水溶液供給部，酸水溶液供給部および溶剤供給部からなり、洗浄液導入変換フランジ16を通じて真空ポンプ内に酸，純水，アルカリ，純水，溶剤の順で供給し、最後にN_2で乾燥するようにした。

【0018】また、洗浄液導入変換フランジ16としては図2の（A），（B），（C）で示す三種類のものを使用した。すなわち、それぞれの変換フランジの外側にはヒーターテープ21と断熱材22を備えており、また、配管23をヒータ24で加熱すると共に、その先にシャワー管25を備え、洗浄液を如雨露状に散布するよう構成した。こゝで、シャワー管25からの矢印は散布方向を示すもので、（A），（B），（C）ぞれぞれ散布方法が異なっている。

【0019】次に、反応ガスとして$SiHCl_3$，NH_3およびN_2の三成分ガスを使用し、また、真空ポンプ3として二連のドライポンプ11を使用した。さて、Siウエハ上にSi_3N_4 からなる絶縁層を形成する工程について排気系の洗浄方法を説明すると、図1においてCVD反応の終了後、排気系を80℃に加熱してある状態でバルブ13と14を閉じ、洗浄液導入変換フランジ16より弗酸(HF)水溶液を供給して二つのドライポンプ9を満たし、10分間放置してSi_3N_4 を溶解した後、バルブ14を開けてHF水溶液を除去し、次に、純水を3リットル／分の流量で1分間洗浄し、次にアンモニア水溶液（NH_4OH）を3リットル／分の流量で1分間洗浄して中和し、次に、純水を3リットル／分の流量で1分間洗浄して後、エチルアルコールで洗浄し、水を置換した後、N_2を10リットル／分の流量で20分間供給して乾燥することにより洗浄が終わった。な

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お、三種類の洗浄液導入変換フランジ16については有意差は認められなかった。

【0020】

【発明の効果】本発明の実施によりＣＶＤ装置の排気系の洗浄回数を減少することができ、また、真空ポンプを排気系より取り外すことなく洗浄を行なうことができることから半導体集積回路の製造コスト低減に寄与することができる。

【図面の簡単な説明】

【図１】　本発明に係るＣＶＤ装置の排気装置の構成図である。

【図２】　洗浄液導入変換フランジの構成を示す断面図である。

【図３】　従来のＣＶＤ装置を構成している排気装置の構成図である。

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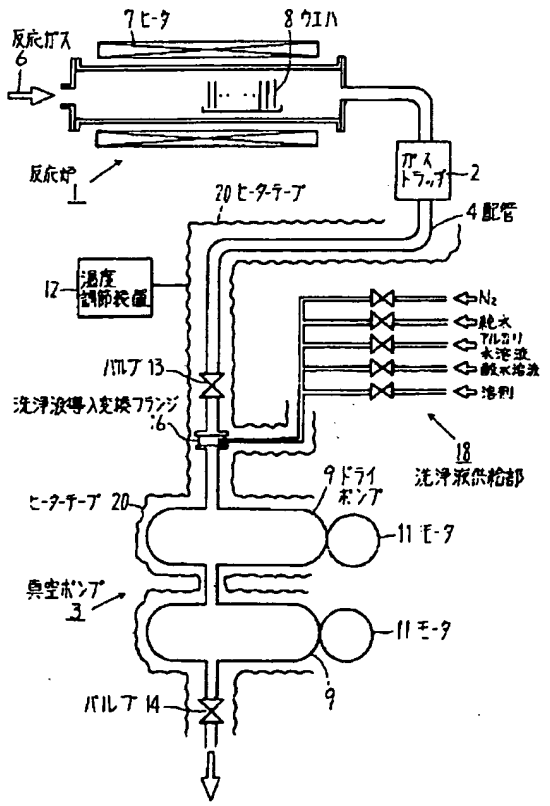
【符号の説明】

1	反応炉
2	ガストラップ
3	真空ポンプ
4	配管
5，13，14	バルブ
6	反応ガス
9	ドライポンプ
11	モータ
12	温度調節装置
16	洗浄液導入変換フランジ
18	洗浄液供給部
20，21	ヒータテープ
25	シャワー管

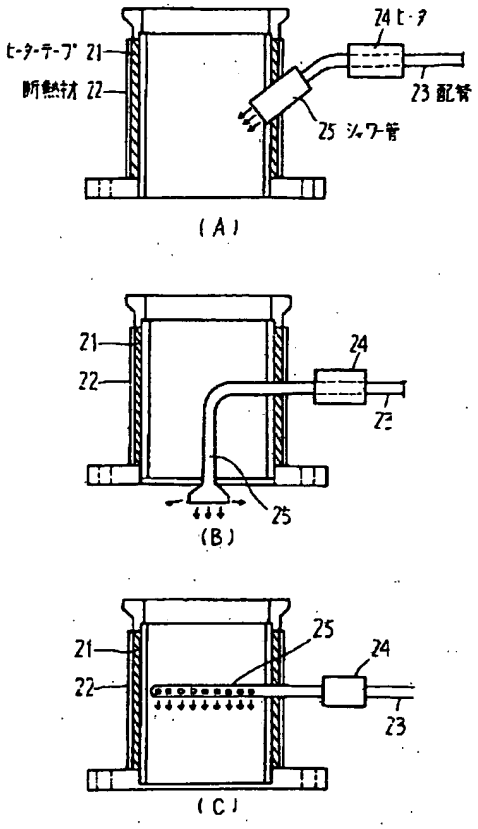
【図１】

本発明に係るＣＶＤ装置の排気系の構成図



【図２】

洗浄液導入変換フランジの構造を示す断面図



【図3】

従来のCVD装置を構成している排気系の構成図